



## ~~~~ Polymer Physics Seminar ~~~~

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**301 Steidle Bldg.**

### **Design and Chemistry of Polymer Electrolyte Materials with Controllable Transport Properties**

It is known that polymer electrolyte fuel cells are still one step away from becoming a viable and wide-spread energy technology, and the primary reason is the lack of feasible polymeric electrolyte materials. Nafion and other analogous perfluorosulfonate polymers are currently the leading materials in this business, but they have high production cost as well as certain limitations. They are not able to work at temperatures higher than 90 °C and require high humidification. Elevating the working temperature to above 110 °C is highly desirable and critical for automotive applications. Associated benefits with high temperature operation include improved tolerance of electrodes to carbon monoxide, simplification of the cooling system and possible use of cogenerated heat, and improved electrode reaction kinetics, etc. Moreover, perfluorosulfonate polymers fail to perform well in fuel cells fed with methanol due to the fuel crossover issue. Methanol is an important alternative fuel of choice to hydrogen, because it is free of massive production and distribution problems. These issues lead to two major research thrusts in the current development of new polymer electrolyte materials, i.e. polymers that can work at high temperatures (110-140 °C), low humidities and that have low methanol crossover. Our research work covers both these material needs, and has produced a family of new materials that demonstrate outstanding electrolyte properties and show great promise for practical use in fuel cells as well as for fundamental academic research. Several research projects including cross-linked fluoropolymers networks, acid-functionalized silica/Nafion composites and aromatic polymers with super-acid groups will be introduced in this talk.